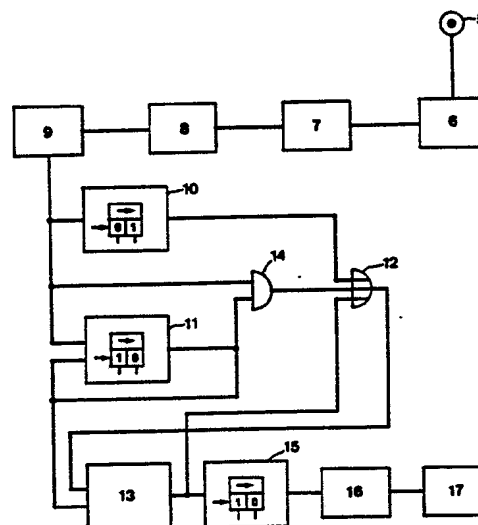


INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification⁴ : A61F 5/56	A1	(11) International Publication Number: WO 87/ 02577 (43) International Publication Date: 7 May 1987 (07.05.87)
(21) International Application Number: PCT/SE86/00488 (22) International Filing Date: 23 October 1986 (23.10.86) (31) Priority Application Number: 8505040-9 (32) Priority Date: 25 October 1985 (25.10.85) (33) Priority Country: SE (71)(72) Applicants and Inventors: PÅLSGÅRD, Göte [SE/SE]; Nygatan 28, S-702 11 Örebro (SE). BIRGNING, Torbjörn [SE/SE]; Persgården Låa, S-714 00 Kopparberg (SE). NYGREN, Nils-Olof [SE/SE]; Björkvägen 10, S-717 00 Storå (SE). PERSSON, Carl-Eric [SE/SE]; Juthemmanet Låa, S-714 00 Kopparberg (SE). VIKTERLÖF, Karl-Johan [SE/SE]; Olaigatan 36 nb., S-703 61 Örebro (SE).		(74) Agent: BJERKÉN, Jarl, Håkan; Bjerkéns/Gävle Patentbyrå AB, Box 304, S-801 04 Gävle (SE). (81) Designated States: AT (European patent), AU, BE (European patent), BR, CH (European patent), DE (European patent), DK, FI, FR (European patent), GB (European patent), IT (European patent), JP, LU (European patent), NL (European patent), NO, SE (European patent), US. Published <i>With international search report.</i>

(54) Title: A DEVICE FOR PREVENTING OF SNORING**(57) Abstract**

A device for preventing snoring of a sleeping person comprises an arrangement (5-9) for detecting snoring sounds and an apparatus (17) controlled by this arrangement and adapted to influence said person to stop possible snoring, said arrangement having sound-receiving means, preferably a microphone (5) and at least one frequency filter (6, 8), arranged to deliver signals deriving from sounds with frequencies typical for snoring sounds in order to determine if the present sound derives from snorings. In this device said arrangement further comprises means (10-14) for determining if the signals delivered by the sound-receiving means are periodically appearing with time intervals, which are typical for snorings. Said means comprises a counter (13) which is arranged to count the number of snorings. The arrangement (5-14) of the device is adapted to send activating control pulses to said apparatus when the counter (13) has detected a predetermined number of successive snorings with said time intervals.



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A device for preventing of snoring.

FIELD OF INVENTION AND PRIOR ART

This invention relates to a device for preventing of snoring of a sleeping person according to the preamble of the claim 1.

It is well known that when two or more persons are going to sleep in the same room frequently the inconvenience occurs that someone of the persons produces snoring sounds and as a consequence thereof either obstructs the falling asleep of the other or wakes up someone of the other. This problem is probably most common among two persons who are living together and sleeping in the same bed, but can also be rather severe under other circumstances, for example in hospitals. In the latter case it may be impossible for a bedridden patient to bring the snorer to stop the snoring without waking up all the other lying in the ward. In some cases the problems can be so great that two persons living together choose to sleep in separate rooms, in spite of the several drawbacks it will result in. Therefore it is very desirable to be able to apply a device which prevents the snoring of a sleeping person and in doing so preferably not awakes him or other persons sleeping in the same room. A device for this purpose is the object of this application.

A device of this kind is described in the Swedish patent application 8204375-3. This device comprises an apparatus in the form of two electrodes intended to be brought in touch with the sleeping and possibly snoring person, e.g. by putting them as a bracelet around his wrist. The electrodes are fed with a voltage, and do accordingly give the person in question a small electrical shock as soon as the sound with a frequency which is characteristic for snorings is registered by a microphone included in the device. Through said electrical shock the snoring person is influenced to either change his sleeping position, so that the snoring disappears (the delivering of electrical shocks will not end before this happens), or to wake up.

This device has drawbacks which the present invention strives after to reduce considerably. In the first place it is very unfortunate that the sleeping person is getting an electrical shock in the same moment as a sound with a frequency similar to that of snoring sound is propagated in the bedroom. In the second place it is quite possible that this sound does not even derive from him, but is a background sound. But if it nevertheless is originating from said person, it is possible that he has talked in his sleep or produced a single snoring or snuffling or the like. In all the cases it is unnecessary to influence the person to change his sleeping position and/or wake up, since it is not sure at all that he disturbs or can be expected to disturb anyone else in the room. It is true that the snoring of a person in question is prevented by this device, but the probability of unnecessarily disturbing this person is very high.

The object of the present invention is to provide a device of the above-mentioned kind, which influences a sleeping person solely if he snors continuously during

a rather long time interval and so that he stops snoring, at the same time as the device prevents such an influence when the sounds registered by the microphone are not originating from snorings.

SUMMARY OF THE INVENTION

In accordance with the invention this object is obtained by providing the device with the characteristics of the characterizing part of claim 1.

The advantages of the device according to the invention are achieved through the understanding that snorings are periodically appearing in typical time intervals, and that the device is provided with means, which test if a detected sound has this periodicity and which are arranged to control the arrangement to influence the snorer solely if he has produced a predetermined number of successive snorings with said time intervals.

As a result of this background noises and isolated snorings cannot cause unnecessary influencing and disturbing of the sleeping person, but he is only influenced when he is really snoring during a prolonged period of time, e.g. 30 seconds. Not until the snoring is proceeding over a certain period of time it will have a disturbing influence upon the people in the surroundings. Naturally, a person that has not yet fallen asleep or a sleeping person is hardly disturbed by one single snoring in his trying to sleep. Thus, the advantages with respect to the device already known are apparent.

BRIEF DESCRIPTION OF THE DRAWING

With reference to the appended drawing, below follows a specific description of a preferred embodiment of

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the device according to the invention described as an example.

In the drawings:

Fig 1 is a schematic view of a sleeping person with the device according to the invention localized under the bed mattress, and

fig 2 is a block diagram which roughly shows the constitution of said device and its way of functioning.

DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT

In fig 1 there is shown a sleeping person 2 lying on a bed 1. A box 4 is located under the bed mattress 3 at the level of the head of the person. The complete device according to the invention except for an electricity source and its wires for the connection with the components in the box is disposed in this box. The elements being located outside the box are without importance for the invention and are accordingly not shown in the figures. It is also possible to arrange the power supply by means of one or more batteries, which in such a case can be disposed inside the box and by that enable a simple application and moving of the device according to the invention.

With reference to fig 2 the constitution and the function of the device according to the invention will now be described more in detail. When a person is snoring only the snoring sounds with low frequencies (in the order of 200 Hz and less) do propagate through the pillow and the bed mattress, so that these are going to act as a low-pass filter. Since the snorings have typical frequencies of about 100 Hz it is advantageous to locate the device under the pillow and/or the matt-

ress, in order to use the two latter to filter out possible sounds not emanating from snoring. The acoustic waves which are reaching the box 4 are striking on the microphone 5 disposed therein, which transforms the sound into electrical signals. These are conducted to a high-pass filter 6 with a lower frequency limit of 80 Hz and an intensity reduction of 6 dB/octave in the direction towards lower frequencies. The signals then reach an amplifier 7 which is amplifying them by 40 dB. After that they are passing a filter assembly 8, which in this case consists of three band-pass filters connected in series and having a middle frequency of 100 Hz and each an intensity reduction of 12 dB/octave in both directions on the frequency scale. The signals now coming out from the filter assembly are almost without exception deriving from sounds with a frequency of $100 \text{ Hz} \pm 20 \text{ Hz}$. As already mentioned this corresponds to the frequency of typical snoring sound. The signals are after this conducted to an AC/DC-converter 9, in which they are converted to direct current.

The object which is now going to be described is forming means for determining if the signals passing through all the filters are periodically appearing with time intervals, which are typical for snorings, in order to find out if the signals are deriving from snorings.

When a logical 1-state or 0-state are discussed below, it is not necessary that there is a signal or no signal respectively, but it is also possible that a strong and a weak signal respectively are meant. For the reason of simplifying the word "logical" is omitted below.

The AC/DC-converter 9 delivers the 1-state at the output when it is reached by acoustic signals registered by the microphone and continuing at least for 0,3 seconds. The output of the AC/DC-converter is connected to a first 10 and a second 11 monostable flip-flop. The

first and the second flip-flop are triggered simultaneously when a signal (corresponding to a snoring) stops coming from the converter 9, so that they are delivering a 0-state at the output during approximately 5 seconds and a 1-state during approximately 1,5 seconds respectively. The period of time of the first flip-flop is after that prolonged by 5 seconds if a signal is arriving from the converter before the first period of time expires. As long as the snoring is continuous this flip-flop will never get a 1-state at the output, but if on the contrary the interruption between two snorings is longer than 5 seconds a 1-state at the output will be conducted to an OR-gate 12 which in its turn delivers a 1-state at the output, which is conducted to a resetting input of a counter 13 counting the number of snorings. Accordingly, the purpose of the first flip-flop is to ensure that sounds which are not returning within a predetermined period of time here 5 seconds, are not counted as (disturbing) snorings.

The output of the second flip-flop 11 is fed back to the input, so that a new triggering cannot prolong the period of time (1,5 seconds) during which it delivers a 1-state at the output. The output of the second flip-flop is also as well as the output of the AC/DC-converter connected to the input of an AND-gate 14. The output of the AND-gate is in its turn connected to the input of the OR-gate 12. As a consequence of this fact, if a 1-state is delivered at the output of the converter during the first 1,5 seconds after the preceding 1-state disappeared and accordingly while the second flip-flop 11 has a 1-state at its output, the AND-gate 14 delivers the 1-state at its output and the counter 13 is reset. Accordingly, the purpose of the second flip-flop is to ensure that sounds that do not have a predetermined minimum time interval, here 1,5 seconds,

before they occur again, are not counted as snorings either. By this it is possible to exclude the registering of talking in sleep and possible background sounds as being snorings.

The output of the second flip-flop 11 is also connected to an input of the counter 13, which counts a snoring when the 1-state at the output of said flip-flop changes to a 0-state. The counter delivers after a predetermined number of counted snorings, e.g. five, a 1-state at its output. This number may be externally adjusted, but it is also possible to fix it in the manufacturing of the device. Thus, when it has been recognized and settled that a sleeping person is continuously snoring, the counter will deliver a 1-state at its output which is conducted to a third monostable flip-flop 15, which by this state is triggered to a 1-state at its output during a time of about 5 seconds. At the same time a signal is conducted from the output of the counter to the OR-gate, which causes the resetting of the counter. The signal from the third flip-flop 15 is led to a power unit 16 which is driving an apparatus 17 adapted to influence a snoring person, so that he stops snoring. The apparatus consists here of a vibrator sending out vibrations perceptible to the sleeping person which are influencing him to change his sleeping position without waking up. If he does still snore the vibrator 17 stops acting upon him, the cycle described above is started again, in order to start acting upon the snorer after five additional snorings, preferably in such a manner that he changes to a position ending the snoring.

The arrangement for detecting of snoring sounds comprises in accordance with the above the elements 5-14, the elements 10-14 of which constitute said means.

The device according to the invention is not at all limited to the embodiment example described above, but all kinds of modification possibilities should through the knowledge of the invention be obvious to a man skilled in the art without deviating from the scope of the invention.

The values of time periods, frequencies, and the like mentioned above can naturally be varied in an appropriate manner. It is also possible to obtain the same function as above by means of other types of circuit diagrams. The elements of the device do not necessarily have to be disposed in one and the same box, although this can be very convenient. The latter does not have to be intended to be located under the mattress either.

The apparatus acting upon the snorer can for example transmit acoustic signals only registrable by that person, induce a moving of the pillow in order to change the head position of the snorer or influence the snorer in another appropriate manner to stop his disturbing activity preferably without waking him up.

It would also be possible to design the arrangement of the device so that it besides snorings also measures other periodical body functions, for example heartbeats or the like, in order to deliver information intended to be used in an appropriate manner.

Finally the apparatus 17 could be arranged to wake the snoring person up if it would be necessary in order to influence him to stop snoring.

Claims

1. A device for preventing snoring of a sleeping person, comprising an arrangement (5-9) for detecting snoring sounds and an apparatus (17) controlled by this arrangement and adapted to influence said person to stop snoring, said arrangement having sound-receiving means, arranged to deliver signals when sound deriving from snoring is received by said means, c h a r a c - t e r i z e d in that said arrangement further comprises means (10-14) for determining if the signals delivered by the sound-receiving means are periodically appearing with time intervals, which are typical for snorings, said means (10-14) comprising a counter (13) which is arranged to count the number of snorings, said arrangement (5-14) being adapted to send activating control pulses to said apparatus when the counter (13) has detected a predetermined number of successive snorings with said time intervals.

2. The device according to claim 1, c h a r a c t e - r i z e d in that a microphone (5) of said sound receiving means is designed to be arranged under the bed mattress (3) and/or the pillow, which accordingly is intended to act as a lowpass filter.

3. The device according to claim 1, c h a r a c t e - r i z e d in that said means (10-14) comprises first members (10, 12) adapted to reset the counter (13) if no sound is registered within a predetermined period of time after the disappearing of a presumed snoring, in order to prevent activation of said apparatus (17) in the case of not frequently appearing sounds.

4. The device according to claim 3, characterized in that said means (10-14) also comprises second members (11, 14) adapted to reset the counter (13) if another sound is registered within a predetermined, short period of time after the disappearing of a presumed snoring, in order to prevent activation of said apparatus (17) in the case of disturbing noises, thus the counter (13) being arranged to solely count the sounds which are returning after and within a time interval typical for snorings.

5. The device according to claim 1, characterized in that said apparatus (17) comprises a generator adapted to deliver a time-limited, acoustic signal perceptible only by the snoring person and/or a vibrator adapted to deliver time-limited vibrations acting upon the snoring person.

6. The device according to any of claim 1-5, characterized in that the apparatus (17) is adapted to directly or indirectly influence the snoring person so that he changes his sleeping position, but is preferably not woken up.

7. The device according to claim 1 and any of the other preceding claims, characterized in that the apparatus (17) is adapted to stop the influence upon the snoring person after a predetermined period of time and deliver a signal which resets the counter (13), said arrangement (5-14) being adapted to repeat the same cycle until the snorings end.

8. The device according to any of the claims 1-7, characterized in that at least a microphone (5) of said sound receiving means and the apparatus (17) of the device are disposed inside a small box (4) which is intended to be placed under the bed mattress and/or the pillow.

9. The device according to any of the claims 1-8, characterized in that the means (10-14) comprises a first monostable flip-flop (10) adapted to, when the signals from a snoring sound end, be triggered to the 0-state at the output during a predetermined period of time, said period of time being extended if a new snoring signal appears within this period of time, a second monostable flip-flop (11) being adapted to be triggered at the same time as the first one, but to the 1-state at the output during a predetermined period of time, the output of the second flip-flop being connected on one hand to an AND-gate and on the other to its own input, the introduced snoring signals also being connected to the AND-gate, the output of the AND-gate as well as the output of the first flip-flop being connected to the input of an OR-gate (12), the output of the OR-gate being connected to an input of a counter (13) resetting the counter if being in the 1-state, the output of the second flip-flop (11) also being connected to an input of said counter, which adds one to the number of counted snorings each time the output of the last-mentioned flip-flop changes from the 1-state to the 0-state, the counter (13) being arranged to, after a predetermined number of counted snorings, send a signal on one hand to the input of the OR-gate and on the other to a third monostable flip-flop, which is adapted to, through this signal, be triggered to the 1-state at its output during a predetermined period of time, the last-mentioned flip-flop (15) being adapted to deliver control pulses during this period of time, which activate said apparatus (17) in order to influence the snoring person during said period of time.

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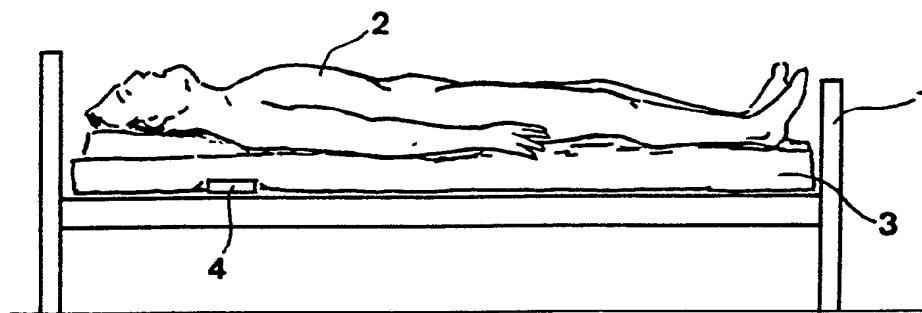


Fig 1

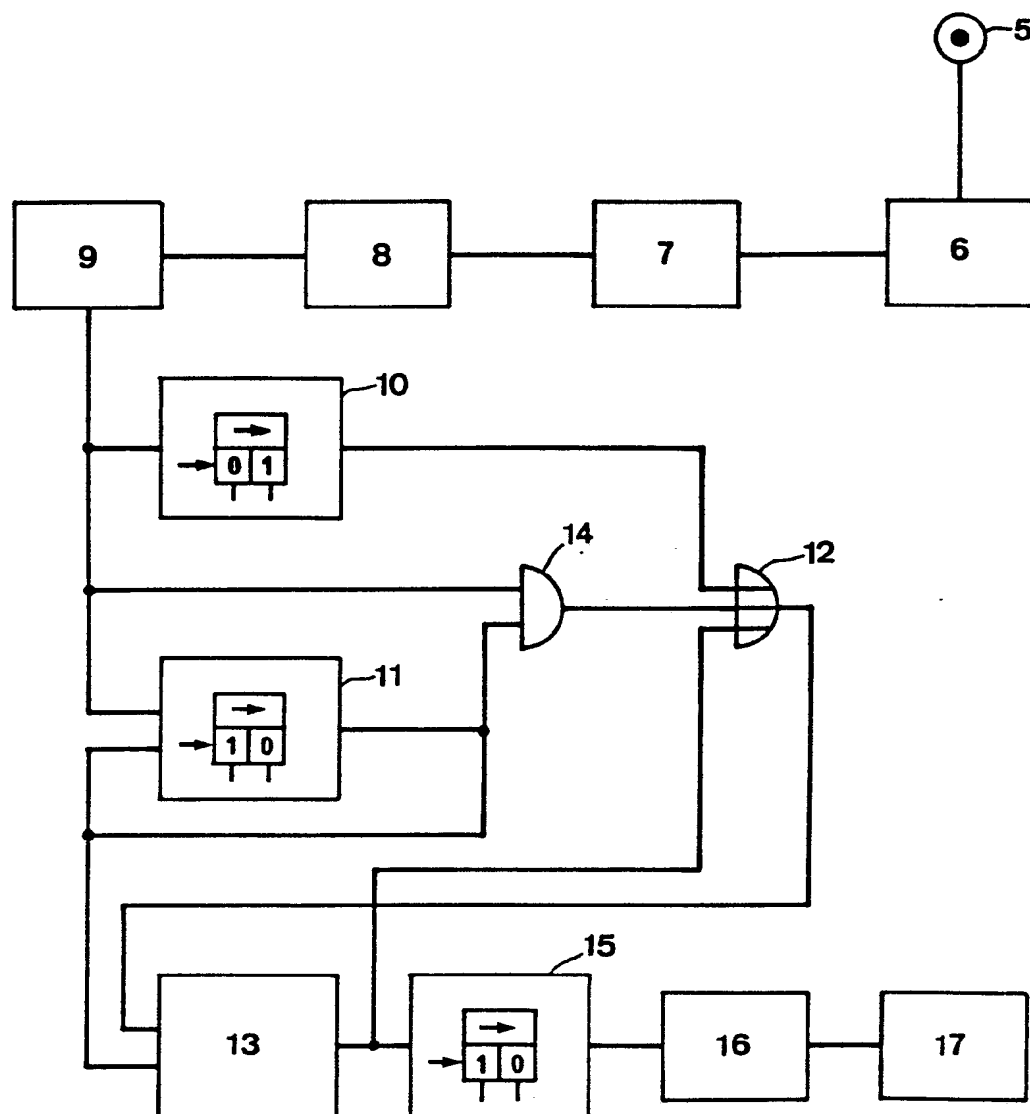


Fig 2

INTERNATIONAL SEARCH REPORT

International Application No PCT/SE86/00488

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) ⁶		
According to International Patent Classification (IPC) or to both National Classification and IPC		
A 61 F 5/56		4
II. FIELDS SEARCHED		
Minimum Documentation Searched ⁷		
Classification System	Classification Symbols	
IPC 4	A 61 F 5/56	
US C1	128:1, 1R	
Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched ⁸		
SE, NO, DK, FI classes as above		
III. DOCUMENTS CONSIDERED TO BE RELEVANT ⁹		
Category ⁹	Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³
X	EP, A2, 145 160 (A. R. DOWLING) 19 June 1985 See p. 6, lines 25-37 & JP, 60100961	1, 3-7, 9
P	EP, A1, 171 321 (J. C. MEQUIGNON) 12 February 1986	1, 5, 6, 9
P	DE, A, 3 439 329 (V. ARENT) 14 November 1985	1, 3-7, 9
A	US, A, 3 998 209 (G. S. MACVAUGH) 21 December 1976	1-2, 5-9
A	US, A, 4 220 142 (R. C. ROSEN ET AL) 2 September 1980	1, 5-9
<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p>¹⁰ Special categories of cited documents:</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> </div> <div style="width: 45%;"> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.</p> <p>"&" document member of the same patent family</p> </div> </div>		
IV. CERTIFICATION		
Date of the Actual Completion of the International Search		Date of Mailing of this International Search Report
1987-01-23		1987-01-27
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